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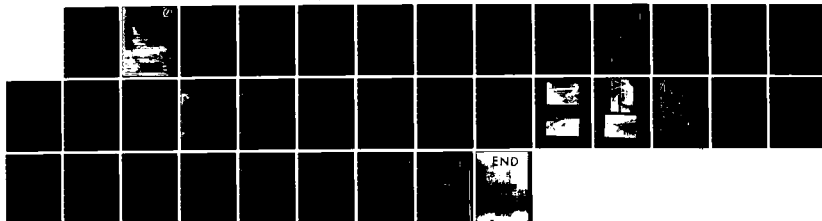
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS  
MOULSON'S POND DAM (CT.) (U) CORPS OF ENGINEERS WALTHAM  
MA NEW ENGLAND DIV JAN 81

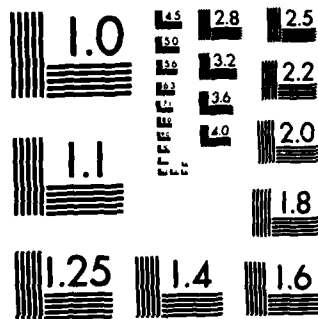
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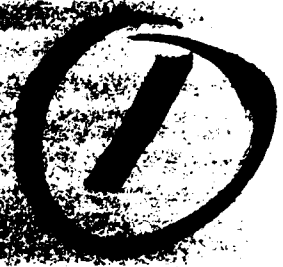
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A



CONNECTICUT RIVER BASIN

LYME, CONNECTICUT

MOULSONS POND DAM

CT 00420

AD-A144 620

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

REMARKS

DTIC  
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DISTRIBUTION STATEMENT

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00420	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Moulsons Pond Dam		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE January, 1981
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 35
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut River Basin Lyme, connecticut		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Moulsons Pond Dam is a stone masonry dam approximately 80 feet long and 23 feet high. In general the overall condition of the dam is GOOD. Moulsons Pond Dam is classified as SMALL in accordance with the Corps of Engineers' <u>Recommended Guidelines for Safety Inspection of Dams</u> . The dam is classified as LOW hazard potential in accordance with the Corps of Engineers. The test flood for this dam ranges from the 50 year flood to the 100 year flood, with the 50 year flood being used because the dam's small size.		

# STORCH ENGINEERS

161 MAIN STREET, WETHERSFIELD, CONNECTICUT 06109

(203) 529-7727

January 28, 1981

Mr. E. P. Gould  
Department of the Army  
New England Division  
Corps of Engineers  
424 Trapelo Road  
Waltham, Massachusetts 02154

Subject: Dam Inspection Program  
Moulsons Pond Dam  
Lyme, Connecticut


Dear Mr. Gould:

Following the field inspection and hydraulic/hydrologic analysis of the subject dam, we conclude that the dam should be reclassified as having a LOW hazard potential.

Please find attached a brief report substantiating our findings.

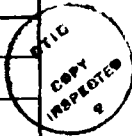
Very truly yours,

STORCH ENGINEERS

  
Gary J. Giroux, P.E.

GJG:11  
Attachment

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
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MOULSONS POND DAM  
CT 00420

CONNECTICUT RIVER BASIN  
LYME, CONNECTICUT

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

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Appendix C - Photographs

Appendix D - Hydraulic/Hydrologic Computations

Appendix E - Inventory Form

## NATIONAL DAM INSPECTION PROGRAM

### PHASE I INSPECTION REPORT

Identification Number:	CT 00420
Name:	Moulsons Pond Dam
Town:	Lyme
County and State:	New London County, Connecticut
Stream:	Eightmile River
Date of Inspection:	November 5, 1980
Owner/Operator:	Lyme Land Conservation Trust, Inc. Old Hamburg Road Lyme, Connecticut 06371

#### DESCRIPTION

Moulsons Pond Dam is a stone masonry dam approximately 80 feet long and 23 feet high. The spillway is "L" shaped with a concrete cap that extends almost the total length of the dam. A bridge spans over the river immediately downstream of the spillway. The top of road is the dam crest and the west bridge abutment is the west spillway abutment. There is a 2-foot high concrete abutment at the east end that is 8 feet below the top of the dam. At the west end of the dam there is a 6-foot diameter pipe that passes beneath the roadway into a sluiceway that goes to an old mill. There is no control for this sluiceway which is always open and the water discharges into the downstream channel. There is no low-level discharge pipe. Plan, section and elevation views of the dam are contained in Appendix B.

The dam was constructed around 1840 and the dam was originally used for power supply. The pond is presently used for recreational purposes only. The pipe to the raceway is always open and the water discharges into the downstream channel. There is neither a formal warning system nor a specific maintenance program for this dam, however, the dam is maintained as the need arises. No design or construction information is available for Moulsons Pond Dam.



In general, the overall condition of the dam is GOOD. A copy of the visual inspection check list and selected photos are contained in Appendix A and C respectively. The structural stability of the dam is good as evidenced by its vertical, horizontal and lateral alignment. Two trees are adjacent to the east spillway abutment. Water which was flowing over the spillway at the time of the inspection obscured the masonry face and any seepage that might have been occurring. The downstream channel is in good condition.

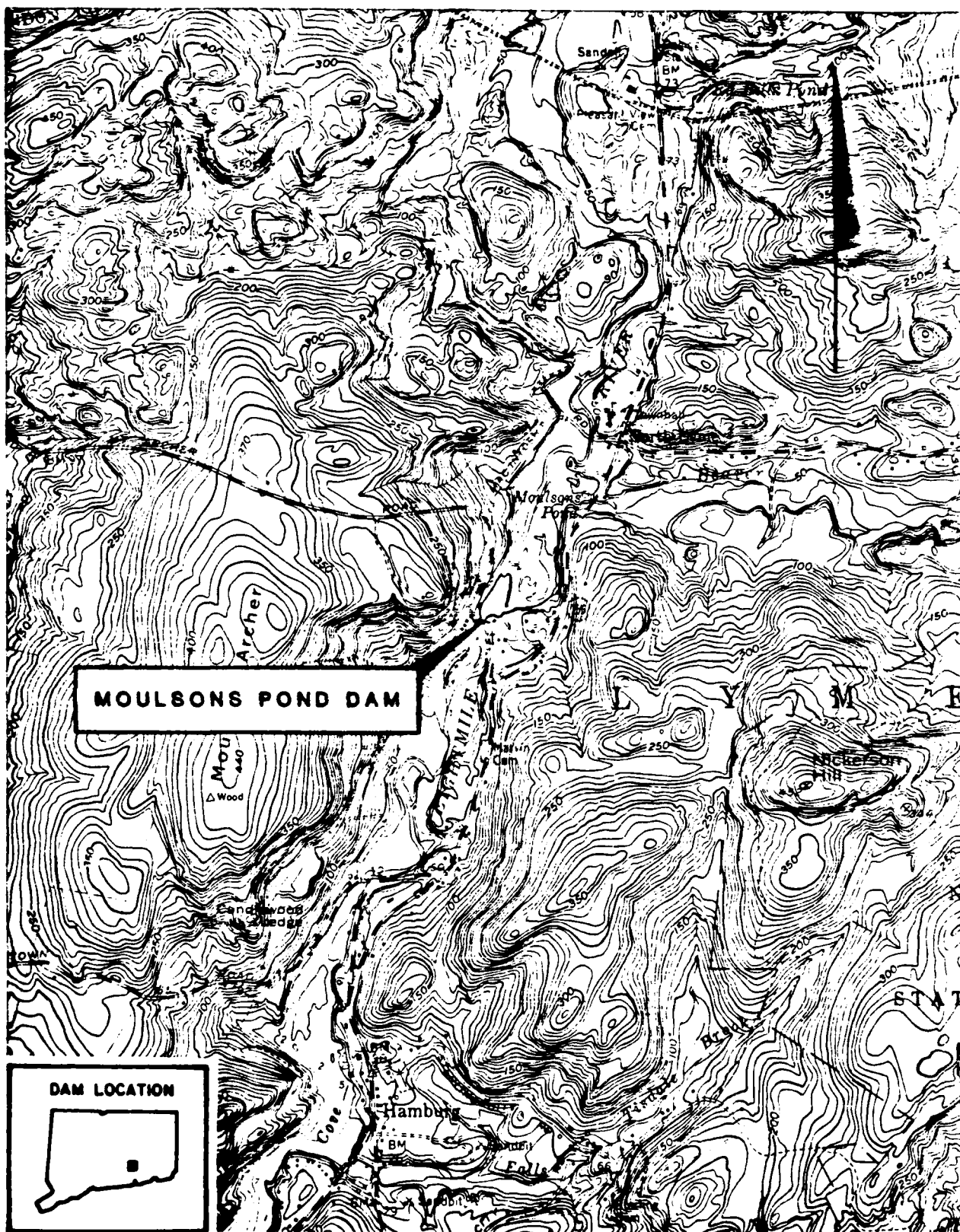
#### EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

The watershed of Moulsons Mill Pond Dam encompasses 53.6 square miles of rolling topography that is 15 percent developed. At the spillway elevation, the water surface area and storage capacity is 16 acres and 100 acre-feet respectively. The storage capacity when the water level is at the top of the dam is 390 acre-feet. With a maximum height of 23 feet and a maximum storage capacity of 390 acre-feet, Moulsons Pond Dam is classified as SMALL in accordance with the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams.

A dam failure analysis was performed using the Rule of Thumb method in accordance with guidelines established by the Corps of Engineers. Failure was assumed to occur when the water level in the pond was at the top of the dam. The calculated dam failure discharge is 5,940 cfs. The flood waters were routed through the downstream reaches. Nowhere along the river reach will the failure floodwave endanger human life or cause appreciable property damage. Therefore, the dam is classified as LOW hazard potential in accordance with the guidelines mentioned above.

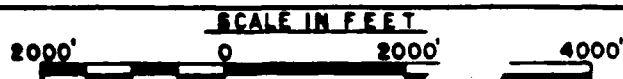
The test flood for this dam ranges from the 50 year flood to the 100 year flood, with the 50 year flood being used because the dam's small size. The test flood inflow is 5,855 cfs and the routed test flood outflow is 5,740 cfs. The

spillway capacity when the water level in the pond is at the top of the dam is 7,285 cfs. The test flood will not overtop the dam. Hydraulic and hydrologic computations are contained in Appendix D.



QUADRANGLE: HAMBURG, CT

US ARMY, CORPS OF ENGINEERS  
NEW ENGLAND DIVISION  
WALTHAM, MASS.



LOCATION MAP

APPENDIX A  
INSPECTION CHECK LIST

# **INSPECTION CHECK LIST** **PARTY ORGANIZATION**

**PROJECT** Moulsons Pond Dam

**DATE** 11/5/80

**TIME** 1:30 p.m.

**WEATHER** Sunny, 50's

**W.S. ELEV.** \_\_\_\_\_ **U.S.** \_\_\_\_\_ **DN.S.** \_\_\_\_\_

**PARTY:**

- |                                           |                                       |
|-------------------------------------------|---------------------------------------|
| 1. <u>Gary Giroux, S.E., Hyd./Struct.</u> | 6. <u>Mike Quatromoni, DBA, Civil</u> |
| 2. <u>Hermann Hani, S.E., Technician</u>  | 7. _____                              |
| 3. <u>Ben Cohen, S.E., Civil</u>          | 8. _____                              |
| 4. <u>Mike Pozzato, MA, Mechanical</u>    | 9. _____                              |
| 5. <u>Peter Austin, DBA, Civil</u>        | 10. _____                             |

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Dam Embankment</u>	P. Austin M. Quatromoni	Good
2. <u>Mechanical</u>	M. Pozzato	N/A
3. <u>Spillway</u>	G. Giroux B. Cohen	Good
4. <u>Discharge Channel</u>	G. Giroux H. Hani	Good
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____

# INSPECTION CHECK LIST

PROJECT Moulsons Pond Dam

DATE 11/5/80

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	33 (NGVD)
Current Pool Elevation	23 (NGVD)
Maximum Impoundment to Date	Good, minor erosion at east abutment
Surface Cracks	None
Pavement Condition	Good
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good - minor spalling at east abutment
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Unknown
Vegetation on Slopes	Small trees adjacent to east abutment
Sloughing or Erosion of Slopes or Abutments	Negligible
Rock Slope Protection - Riprap Failures	N/A
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	None visible
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

**INSPECTION CHECK LIST**PROJECT Moulsons Pond DamDATE 11/5/80

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>CUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	N/A
a. Approach Channel	"
Slope Conditions	"
Bottom Conditions	"
Rock Slides or Falls	"
Log Boom	"
Debris	"
Condition of Concrete Lining	"
Drains or Weep Holes	"
b. Intake Structure	"
Condition of Concrete	"
Stop Logs and Slots	"

# INSPECTION CHECK LIST

PROJECT Moulsons Pond Dam

DATE 11/5/80

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<b>OUTLET WORKS - CONTROL TOWER</b>	N/A
<b>a. Concrete and Structural</b>	"
General Condition	"
Condition of Joints	"
Spalling	"
Visible Reinforcing	"
Rusting or Staining of Concrete	"
Any Seepage or Efflorescence	"
Joint Alignment	"
Unusual Seepage or Leaks in Gate Chamber	"
Cracks	"
Rusting or Corrosion of Steel	"
<b>b. Mechanical and Electrical</b>	"
Air Vents	"
Float Wells	"
Crane Hoist	"
Elevator	"
Hydraulic System	"
Service Gates	"
Emergency Gates	"
Lightning Protection System	"
Emergency Power System	"
Wiring and Lighting System in Gate Chamber	"



# INSPECTION CHECK LIST

PROJECT Moulsons Pond Dam

DATE 11/5/80

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

## AREA EVALUATED

## CONDITION

### OUTLET WORKS - TRANSITION AND CONDUIT

N/A

General Condition of Concrete

"

Rust or Staining on Concrete

"

Spalling

"

Erosion or Cavitation

"

Cracking

"

Alignment of Monoliths

"

Alignment of Joints

"

Numbering of Monoliths

"

# INSPECTION CHECK LIST

PROJECT Moulsons Pond Dam

DATE 11/5/80

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	Unknown - underwater
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Few
Floor of Approach Channel	Underwater
b. Weir and Training Walls	
General Condition of Concrete	Good
Rust or Staining	None
Spalling	Minor spalling at east abutment
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None visible
Drain Holes	None
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Few
Floor of Channel	Good
Other Obstructions	

# INSPECTION CHECK LIST

PROJECT Moulsons Pond Dam

DATE 11/5/80

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

## AREA EVALUATED

## CONDITION

### OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL

N/A

General Condition of Concrete

Rust or Staining

Spalling

Erosion or Cavitation

Visible Reinforcing

Any Seepage or Efflorescence

Condition at Joints

Drain holes

Channel

Loose Rock or Trees Overhanging  
Channel

Condition of Discharge Channel

# INSPECTION CHECK LIST

PROJECT Moulsons Pond Dam

DATE 11/5/80

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SERVICE BRIDGE</u>	N/A
a. Super Structure	"
Bearings	"
Anchor Bolts	"
Bridge Seat	"
Longitudinal Members	"
Under Side of Deck	"
Secondary Bracing	"
Deck	"
Drainage System	"
Railings	"
Expansion Joints	"
Paint	"
b. Abutment & Piers	"
General Condition of Concrete	"
Alignment of Abutment	"
Approach to Bridge	"
Condition of Seat & Backwall	"

APPENDIX B  
ENGINEERING DATA

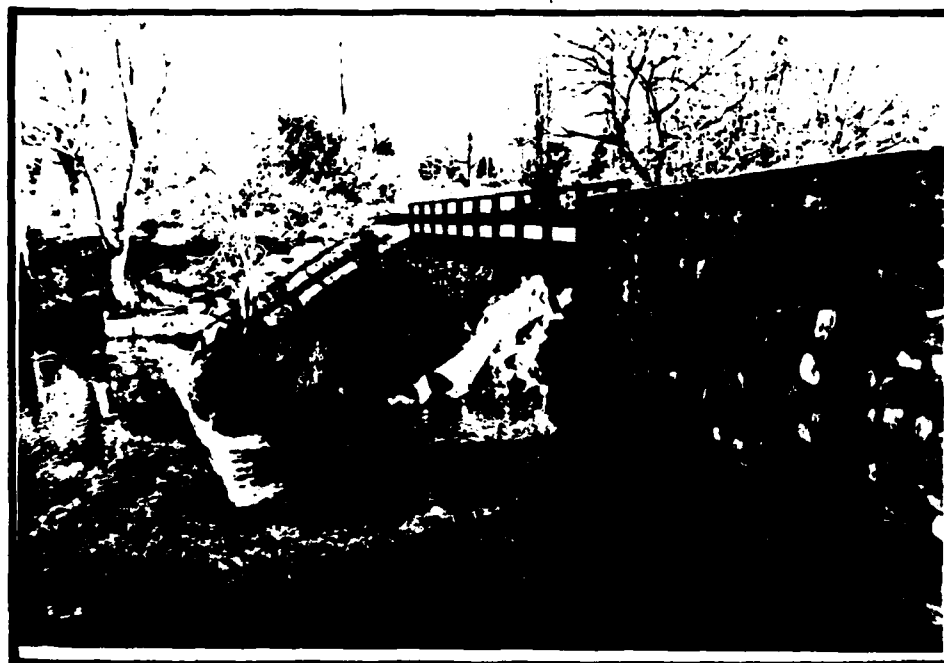
Any information pertaining to the history, maintenance and past inspection reports are located at:

State of Connecticut  
Department of Environmental  
Protection  
Water Resources Unit  
State Office Building  
Hartford, Connecticut 06115

APPENDIX C  
PHOTOGRAPHS

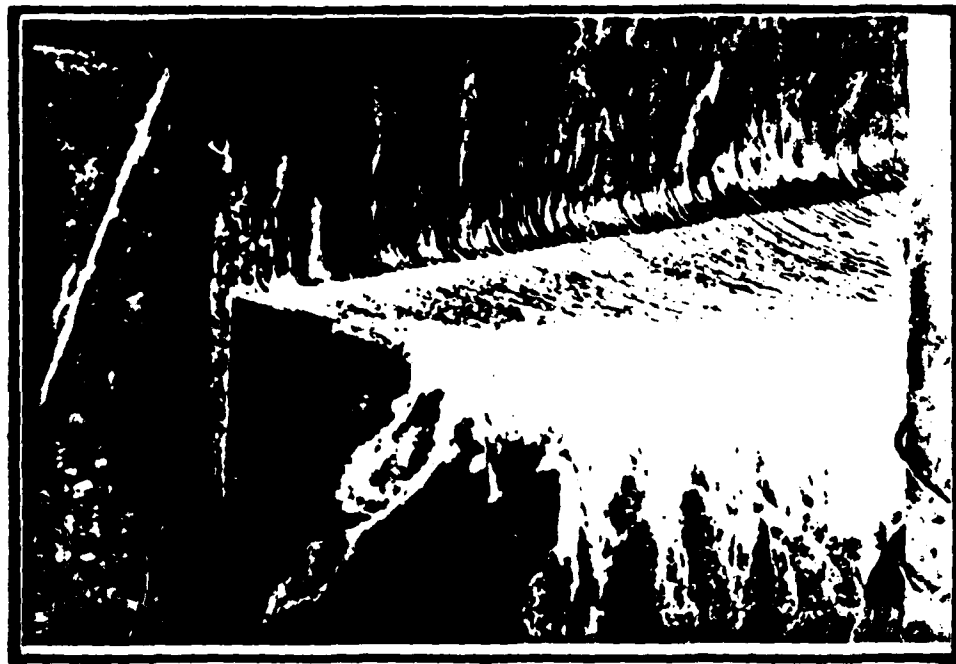


MOULSONS POND DAM



SPILLWAY - DOWNSTREAM BRIDGE





SPILLWAY - WEST ABUTMENT



EAST ABUTMENT



**STORCH ENGINEERS**  
**WETHERSFIELD, CONNECTICUT**

U S ARMY ENGINEER DIV NEW ENGLAND  
CORPS OF ENGINEERS  
WALTHAM MASS.

## NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

## MOULSONS POND DAM

1 in. = 3.5 mi.

**SCALE: AS SHOWN**

DATE JANUARY, 1981

APPENDIX D  
HYDRAULIC/HYDROLOGIC COMPUTATIONS

**STORCH ENGINEERS**  
Engineers - Landscape Architects  
Planners - Environmental Consultants

JOB Phase I Dam Inspection - #4463

SHEET NO. 1 OF 7

CALCULATED BY BDC DATE 11/13/81

CHECKED BY GJG DATE 1/15/81

**Determination of Test Flood**

NAME OF DAM Moulsons Pond Dam

DRAINAGE AREA 53.6 SM

INFLOW Size: Small

Hazard: Low

Test Flood: 50 yr.

$$Q_{50 \text{ yr}} = 252A^{.79}$$

$$Q_{50 \text{ yr}} = 252(53.6)^{.79} = 5,855 \text{ cfs}$$

Estimating the effect of surcharge storage on the Maximum Test Flood

1.  $Q_{p1} = \underline{5,855} \text{ cfs}$

2a.  $H_1 = \underline{8.7'} \text{ (elev.)}$

b.  $\text{STOR}_1 = \underline{.09''}$

c.  $Q_{p2} = Q_{p1} (1 - \text{STOR}_1 / 4.4) = \underline{5,740} \text{ cfs}$

3a.  $H_2 = \underline{8.6'}$   $\text{STOR}_2 = \underline{.09''}$

b.  $\text{STOR}_A = \underline{.09''}$

$$Q_{PA} = 5,740 \text{ cfs}$$

$$H_A = 8.6'$$

$$\text{STOR}_A = .09''$$

Test Flood =  $\underline{5,740} \text{ cfs}$

Capacity of the spillway when the pond elevation is at the top of the dam

$$Q = \underline{7,285} \text{ cfs or } \underline{127} \% \text{ of the Test Flood}$$

### Stage Discharge

$$Q = CLH^{3/2}$$

The graph shows the relationship between head  $H$  (in feet) and flow  $Q$  (in cubic feet per second, cfs) for a spillway. The curve starts at the origin (0,0) and rises to a point labeled "Total Top of Dam" at approximately  $Q = 8500$  cfs and  $H = 11.5$  ft. A horizontal line at  $H = 10$  ft is labeled "Top of Dam".

Flow (cfs)	Head $H$ (ft)
0	0
1000	2.5
2000	4.5
3000	6.0
4000	7.2
5000	8.2
6000	9.2
7000	10.2
8000	11.2
8500	11.5

**STORCH ENGINEERS**  
Engineers - Landscape Architects  
Planners - Environmental Consultants

JOB Phase I Dam Inspection 4463

SHEET NO. 3 OF 7

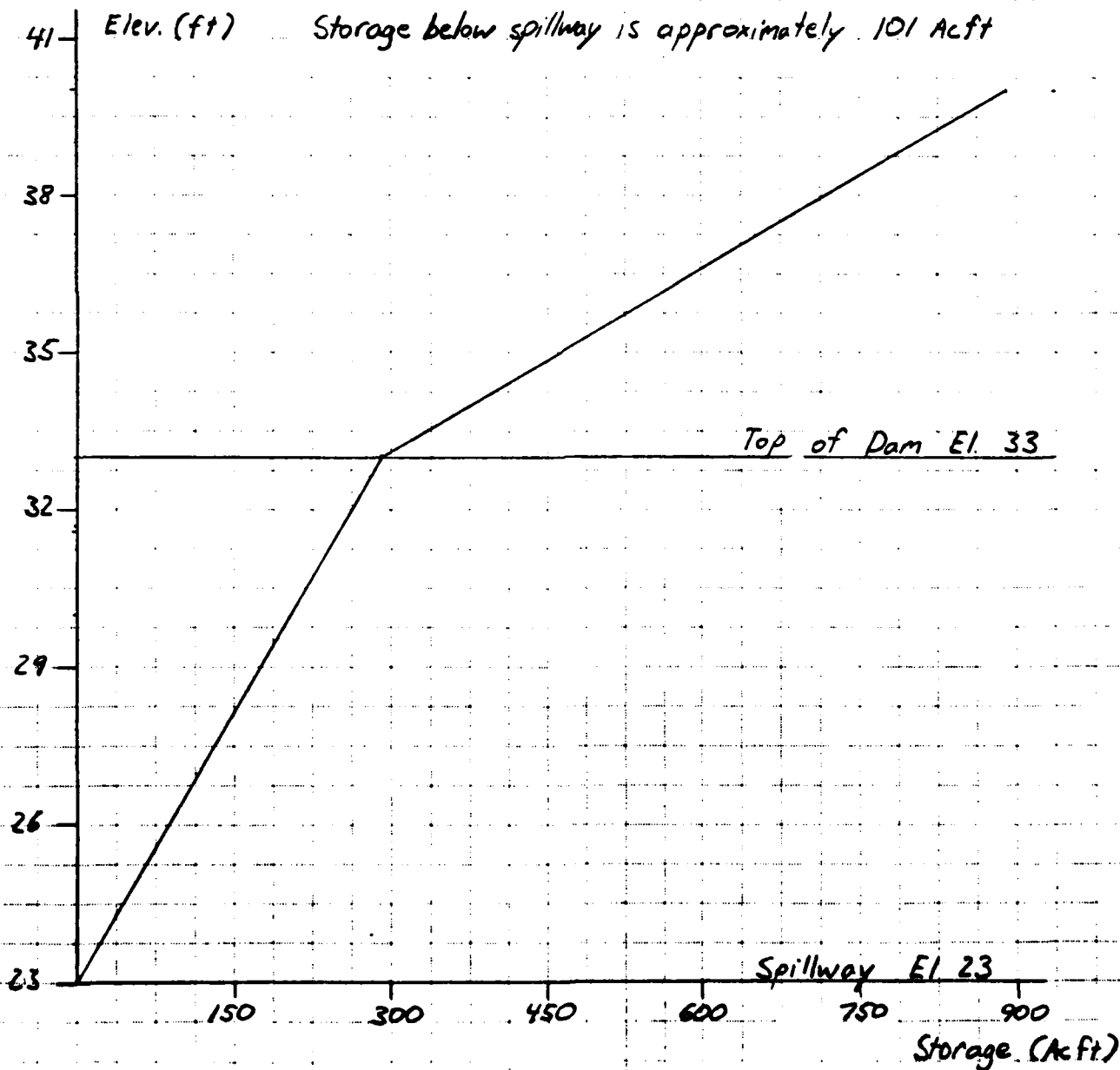
CALCULATED BY BPC DATE 1/13/81

CHECKED BY BJG DATE 1/15/81

**AREA - CAPACITY**

Name of Dam:

ELEV	DEPTH	AREA	AVG. AREA	VOL	Σ VOL
23.0		15.5			0
33.0	10.0	42.5	29.0	290	290
40.0	8.0	107.4	75.0	600	890



D-3

**STORCH ENGINEERS**  
Engineers - Landscape Architects  
Planners - Environmental Consultants

JOB Phase I Dam Inspection - #4463

SHEET NO. 41 OF 7

CALCULATED BY KLL DATE 11/24/51

CHECKED BY BDC DATE 11/7/80

Downstream Hydrographs

"Rule of Thumb" Guidance for Estimating Downstream Failure Hydrographs

NAME OF DAM Moulsons Pond Dam

Section I at Dam

1.  $S = \frac{390}{8/27 W_b \sqrt{g}} \text{ Acft}$
2.  $Q_{p1} = \frac{390}{8/27} (32) \sqrt{32.2} (23)^{3/2} = 5940$
3. See Sections

Section II at

- 4a.  $H_2 = \underline{6.4}$   $A_2 = \underline{1530}$   $L_2 = \underline{370}$   $V_2 = \underline{13.0}$  Acft
- b.  $Q_{p2} = Q_{p1} (1 - V_2/S) = \underline{5737}$  cfs
- c.  $H_2 = \underline{6.7}$   $A_2 = \underline{1500}$   
 $A_A = \underline{1500}$   $V_2 = \underline{12.7}$  Acft  
 $H = 6.7'$
- $Q_{p2} = 5935 (1 - \frac{12.7}{390}) = 5740$

Section III at

- 4a.  $H_3 = \underline{3.3}$   $A_3 = \underline{1900}$   $L_3 = \underline{3250}$   $V_3 = \underline{14.2}$  Acft
- b.  $Q_{p3} = Q_{p2} (1 - V_3/S) = \underline{3650}$  cfs
- c.  $H_3 = \underline{2.5}$   $A_3 = \underline{1400}$   
 $A_A = \underline{1650}$   $V_3 = \underline{12.3}$  Acft  
 $* H = 2.6'$
- $Q_{p3} = 5740 (1 - \frac{12.3}{390}) = 3930$

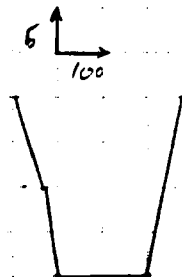
Section IV at

- 4a.  $H_4 = \underline{6.3}$   $A_4 = \underline{1120}$   $L_4 = \underline{700}$   $V_4 = \underline{18.0}$  Acft
- b.  $Q_{p4} = Q_{p3} (1 - V_4/S) = \underline{3750}$  cfs
- c.  $H_4 = \underline{6.1}$   $A_4 = \underline{1090}$   
 $A_A = \underline{1105}$   $V_4 = \underline{17.8}$  Acft  
 $H = 6.1'$
- $Q_{p4} = 3930 (1 - \frac{17.8}{390}) = 3750$

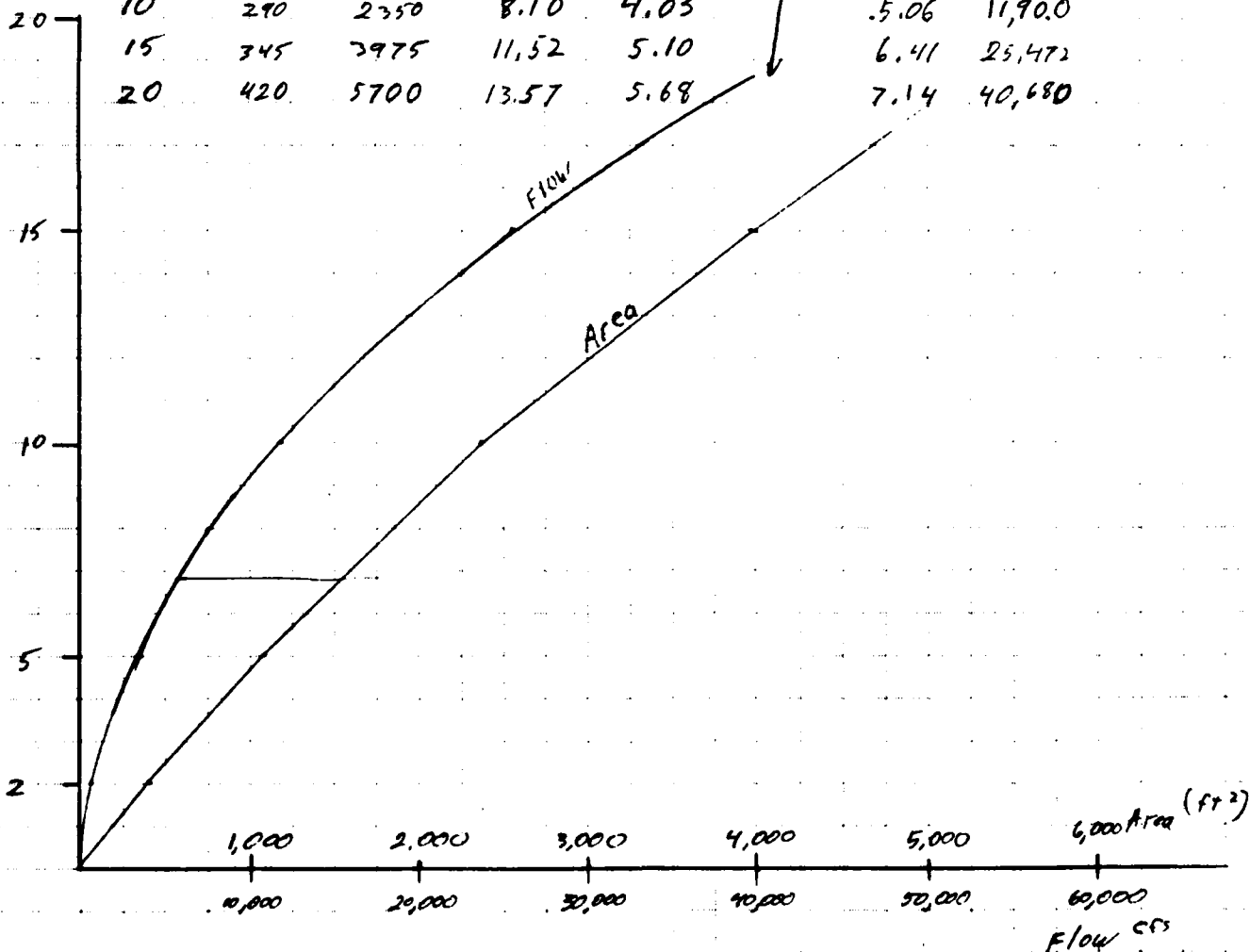
**STORCH ENGINEERS - STORCH ASSOCIATES**  
 Engineers - Landscape architects  
 Planners - Environmental Consultants

JOB MOULSON'S POND DAM  
 SHEET NO 5 OF 7  
 CALCULATED BY Km DATE 11/21/80  
 CHECKED BY RDC DATE 11/21/80  
 SCALE Section II

$S = .4\%$   
 $n = .075$



D	WP	A	R	$R^{\frac{2}{3}}$	$S^{\frac{1}{2}}$	V	Q
2	205	400	1.95	1.56	.0632	1.96	784
5	240	1075	4.48	2.71		3.41	3,660
10	290	2350	8.10	4.03		5.06	11,900
15	345	3975	11.52	5.10		6.41	25,472
20	420	5700	13.57	5.68		7.14	40,680



D-5



# STORCH ENGINEERS - STORCH ASSOCIATES

Engineers - Landscape architects  
Planners - Environmental Consultants

JOB MOULSON'S POND DAM

SHEET NO 6 OF 7

CALCULATED BY KM DATE 1/24/80

CHECKED BY BOC DATE 1/27/80

SCALE Section III

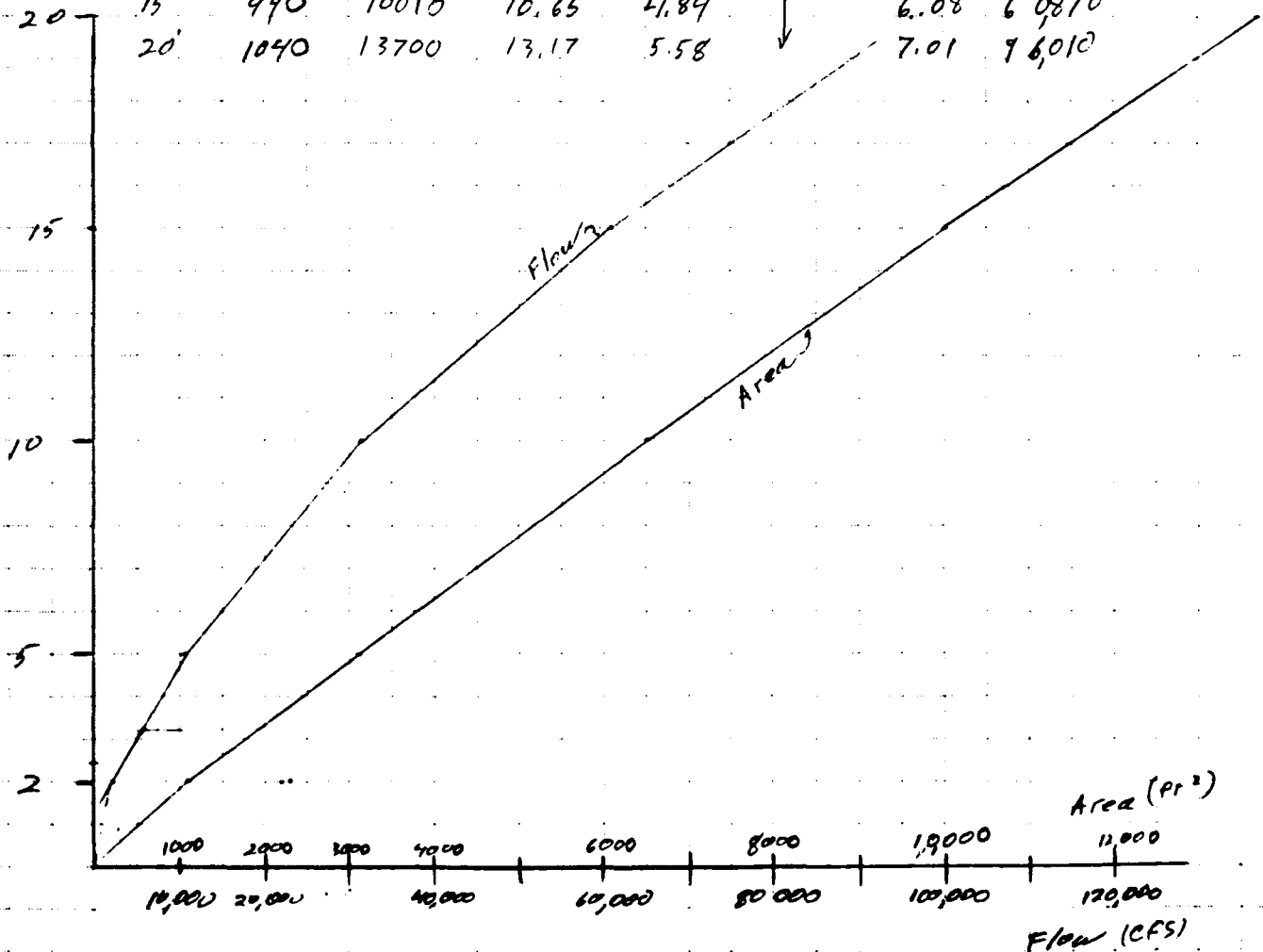
$$S = .470$$

$$n = .075$$

3245



D	WP	A	R	$R^{2/3}$	$S^{1/2}$	V	Q
2	640	1200	1.87	1.52	.0632	1.91	2290
5	700	5120	4.45	2.71		3.40	10,620
10	850	6500	7.65	3.81		4.87	31,700
15	940	10010	10.65	4.84		6.08	60,870
20	1040	13700	13.17	5.58		7.01	96,010



D-6

**STORCH ENGINEERS - STORCH ASSOCIATES**  
 Engineers - Landscape architects  
 Planners - Environmental Consultants

JOB MCULSON'S POND DAM

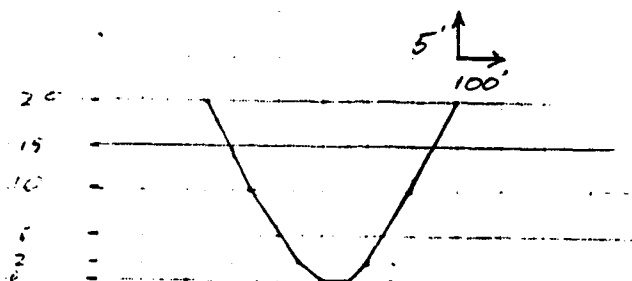
SHEET NO 7 OF 7

CALCULATED BY Ken DATE 11/21/85

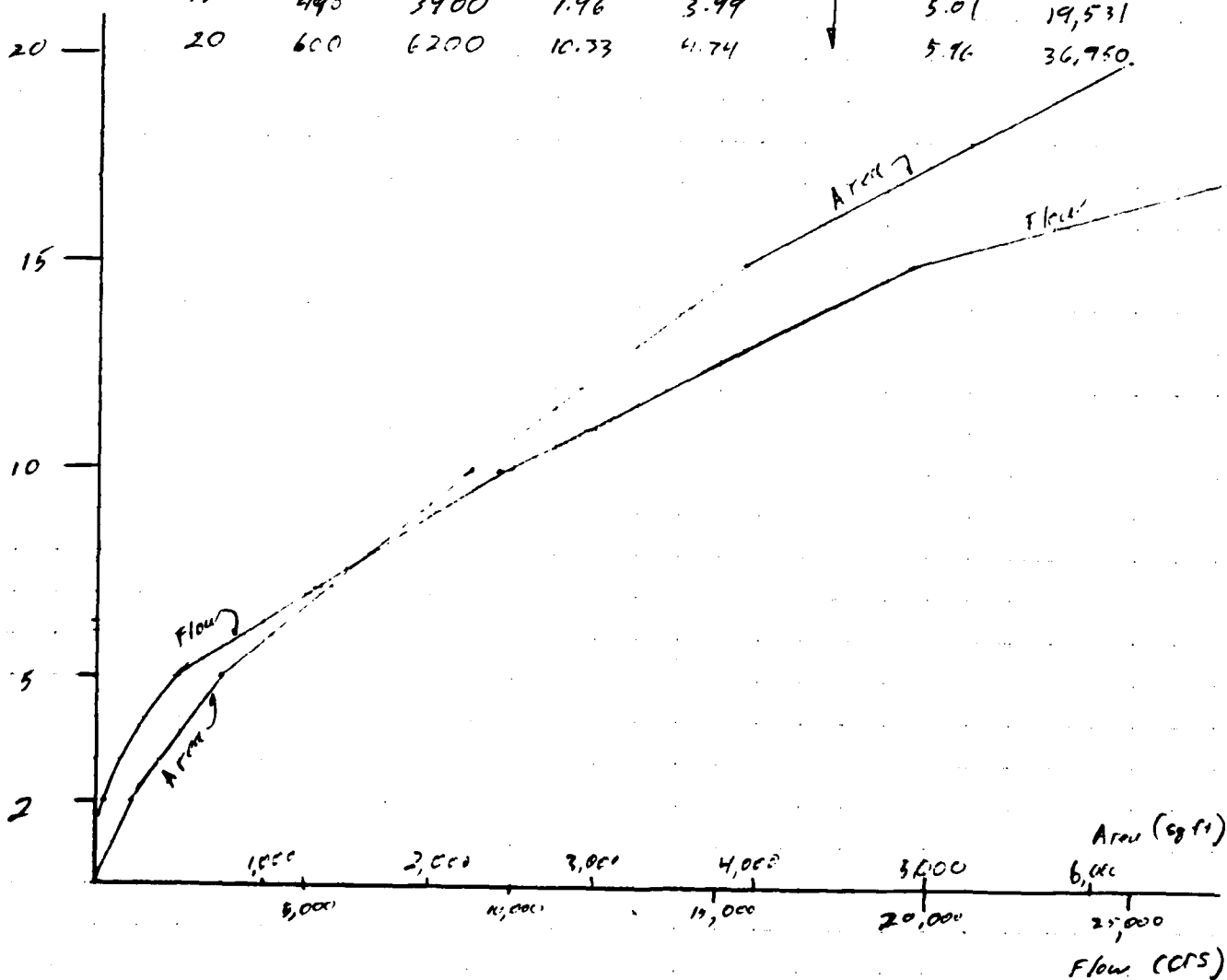
CHECKED BY BDC DATE 11/7/89

SCALE Section IV

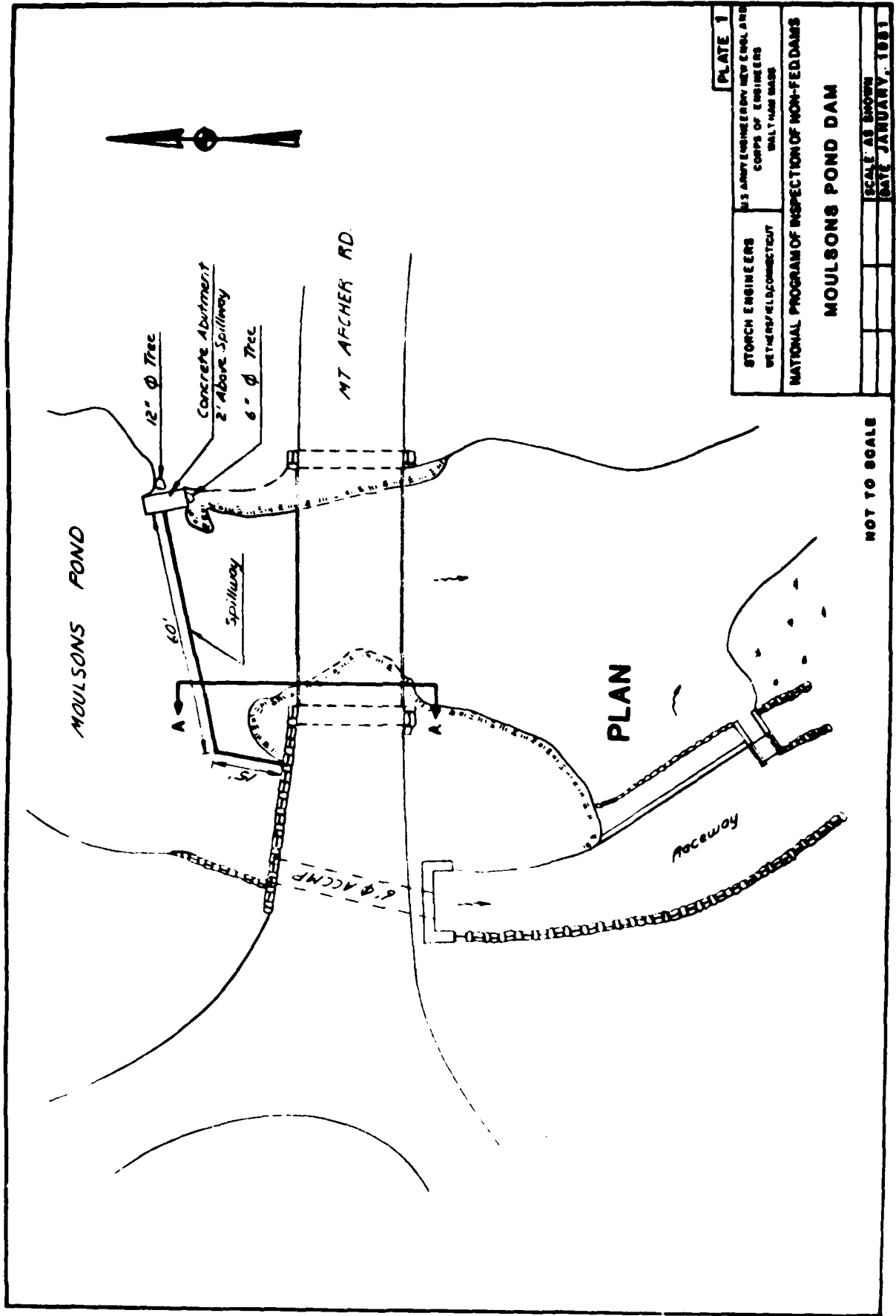
$S = .496$   
 $N = .075$

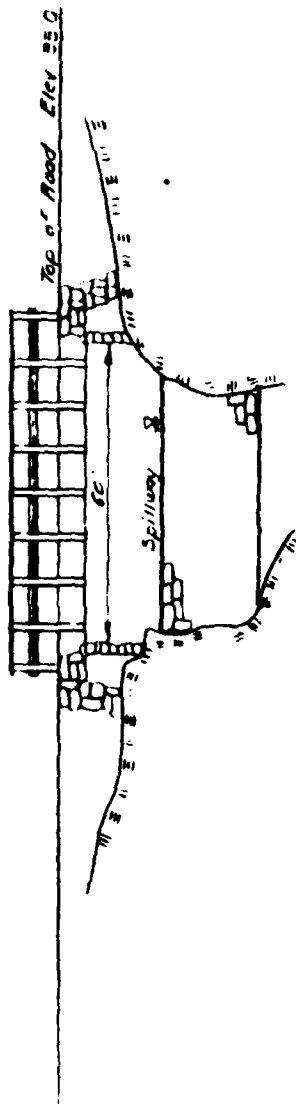


D	WD	A	R	$R^2$	$S^{1/2}$	V	Q
2	155	215	1.39	1.243	.0632	1.56	336
5	250	750	3.00	2.08		2.61	1,960
10	360	2250	6.25	3.39		4.26	9,591
15	490	3900	7.96	3.99		5.01	19,531
20	600	6200	10.33	4.74		5.96	36,950

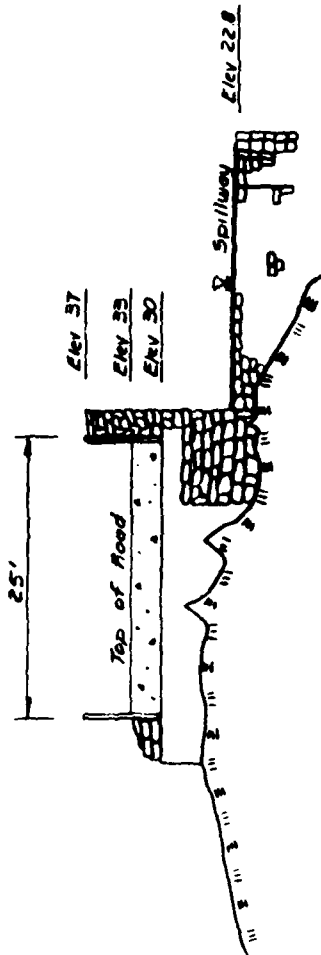


D-7





## ELEVATION



## SECTION A-A

STARCH ENGINEERS WETHERSFIELD, CONNECTICUT	PLATE 2	U.S. ARMY ENGINEERS NEW ENGLAND DISTRICT CORPS OF ENGINEERS WALTHAM MASS
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS		
MOULSONS POND DAM		
		SCALE AS SHOWN
		DATE: JANUARY, 1981

NOT TO SCALE

SCALE AS SHOWN  
DATE JANUARY, 1981

END

FILMED

DTIC